The 5th Meeting of the Coordinating Group of the RA II WIGOS Satellite Project

21 October, Vladivostok city, Russky Island, Russia

Far Eastern Federal University

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I. Introduction
II. Short discription of NMHS activity
III. Current observational system overview
IV. Collection, processing and utilization of satellite data and products
V. Satellite data to address regional challenges

I. Country overview
   I. Geography
   II. Population
   III. Climate
II. Major historical hydrometeorological disasters
   I. Disaster type and distribution
   II. Life and economic loss
III. Major national economic sectors relying on NMHSs
   I. Agriculture
   II. Transportation
   III. …


Kochi
KERALA
Sri Lanka
Laccadive Sea
Colombo
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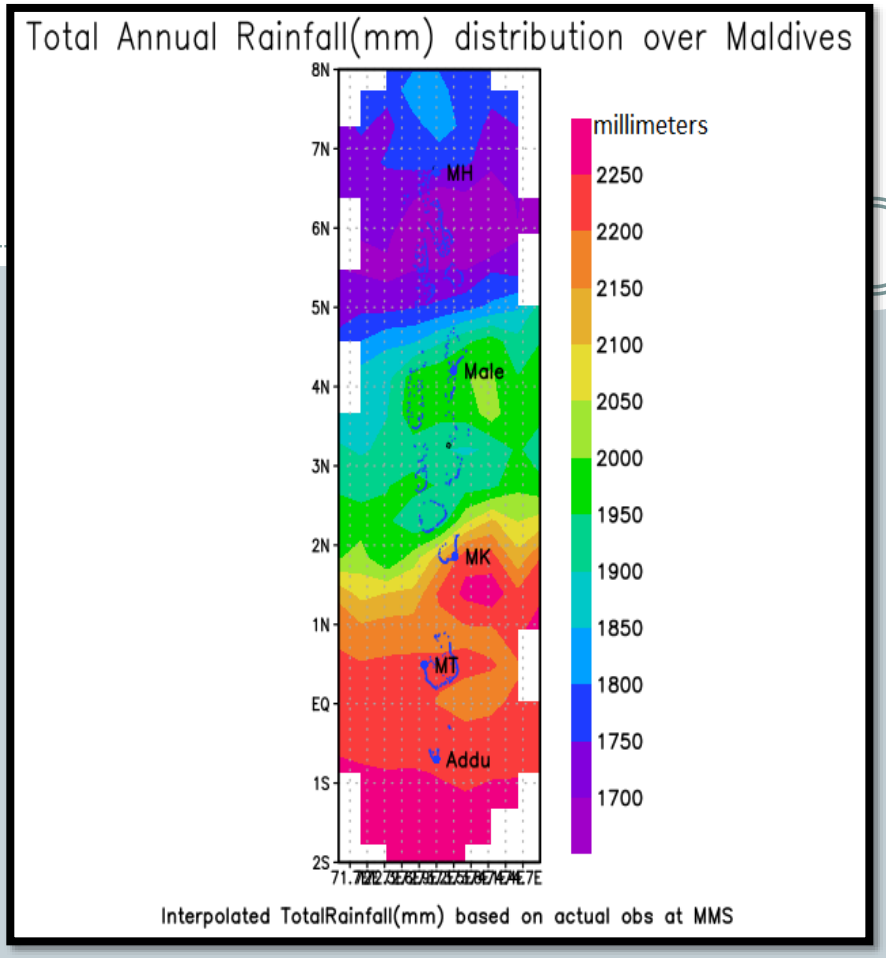
Map data ©2017 Google


KAANI MAGU

- **The Maldives is a tropical nation in the Indian Ocean composed of 26 ring-shaped atolls, which are made up of about 1,200 coral islands.**
- **99% of the country's area is sea.**
- **Average height of the islands are 2m above sea level. Hence, climate change, global warming and sea level rise is a huge concern to Maldives.**

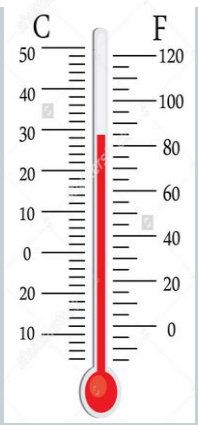
- **Approx. 400,000 people live on 200 islands.**
- **The main economy is Tourism. Maldives is popularly known for its beaches, blue lagoons and extensive reefs.**
- **Marine transportation is another sector where meteorological forecasts are frequently used.**



Climate of Maldives

- Maldives has 2 Seasons:
- South-West Monsoon : May to November
- North-East Monsoon : January to March
- Throughout the year, temperature remains almost same in the Maldives
- Maldives receives sunshine throughout the year

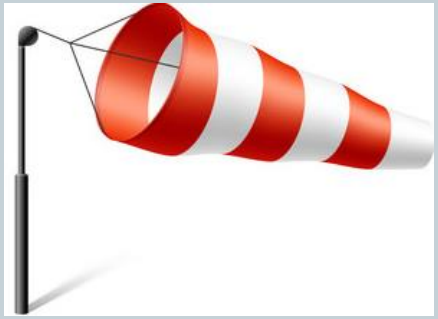
Extreme Weather Records



Highest Temperature:
L. Kadhdhoo record 36.8 ˚C
19 May 1991

Lowest Temperature:
Hulhule’ record 17.2 ˚C
04 October 1978

Highest rainfall:
S. Gan record 228.4 mm
24 November 2015



High winds:

- S. Gan: 103.5 mph 29 May 1991(estimated)
- H. DH. Hanimaadhoo: 89.7 mph 28 August 1991
- Hulhule’: 71.3 mph 03 November 1978
- Kadhdhoo: 69 mph 30 August 1992
- Kaadehdhoo: 63.3 mph 18 July 2003

Meteorological and Hydrological Hazards

- Thunderstorm & Lightening
- Heavy Rain and Flood
- Strong Winds (Gusts, Funnel Cloud, Water Spouts)
- Tidal and Swell Waves
- Tropical Cyclones

Thunderstorm and lightning


HA.Utheem 27th May 2014

- Lightning strike in the antenna near the Mic office in Meemu Muli on 15 Feb, 2012. Many computers were damaged, cost around MVR100000.

- Rasgetheemu Island Council office was struck by lightning on 27th April 2013.
  " lightning struck the antenna on top of the building and computer systems in the office were burned."

- HaaAlifu Ihavandhoo was hit by lighting on 3 June 2014. Electrical appliances, 33 TVs and cable TV decoders were damaged.

- Many houses in Fuvahmulah island were struck by lightning on 28 June 2014. " one house was completely burned".

Thunderstorm and lightning …

- Lightning strike in Dhiraagu Head Office and some of company's towers on 30 October 2014.

- Ibrahim Nasir International Airport was hit by lightning 17 DEC 2015. Some flights had to be diverted. Caused power outages in INIA incl' MMS.

- Noonu Ranmandhoo was hit by lightning on 10 May 2015.

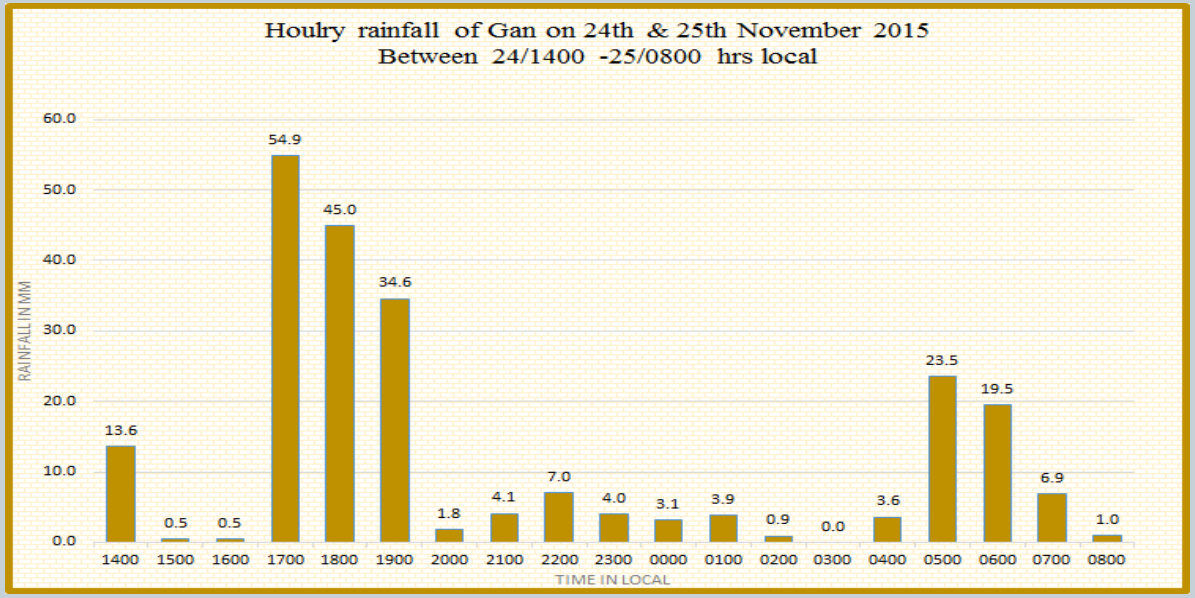
" Dhiraagu equipment, mobile phone, internet, postal and banking services have been disrupted in that island ".

Heavy rain, Flood and Impact

- Heavy rain and flash flood happened to be a prominent feature every year.

October 2016

Extreme weather: flash flood in Addu City



Winds and Gusts

- Maximum Gust Wind speed 50 mph recorded at the National Meteorological Centre - 07 June 2013 at 13:34 hrs.


Tents placed in Market Area were damaged by strong winds on 7 June 2013


Wind lifts roofs of Naifaru school on 16 July 2015

Funnel Cloud and Water Spouts

Funnel cloud hit Feydhoo and Hulhumeedhoo on 29 Oct 2012.
Banana trees were uprooted and some roofs were ripped off.

Funnel Cloud and Water Spouts

Waterspout observed near Sh. Milandhoo on 14 March 2017

Waterspout near Sh. Milandhoo - 14 Mar 2017

Tidal and Swell Waves

- IN 1987, UNUSUAL SWELL / TIDAL WAVE WERE EXPERIENCED IN MALDIVES IN 3 EPISODES (APRIL, JUNE AND SEPTEMBER).
- ON 10-12 APRIL 1987 TIDAL WAVES HIT AND FLOODED A LARGE PART OF MALE' AND CAUSED DAMAGES TO SOME 16 OTHER ISLANDS. THE WAVES WAS CAUSED BY A STORM IN THE SOUTH INDIAN OCEAN NEAR AUSTRALIAN REGION. IT APPROACHED FROM SOUTHEAST AND LASHED IN THE ATOLLS MOSTLY IN THE EAST.
- PHYSICAL DAMAGES INCLUDE: BREAKWATERS, RETAINING WALLS, COASTAL WALLS, ACCESS HARBOR, FUEL JETTY, RADIO ANTENNA AND INTERNATIONAL AIRPORT. NUMBER OF HOUSES WERE AFFECTED, 300 PEOPLE WERE EVACUATED AND HOMELESS.

Tidal and Swell Waves ….

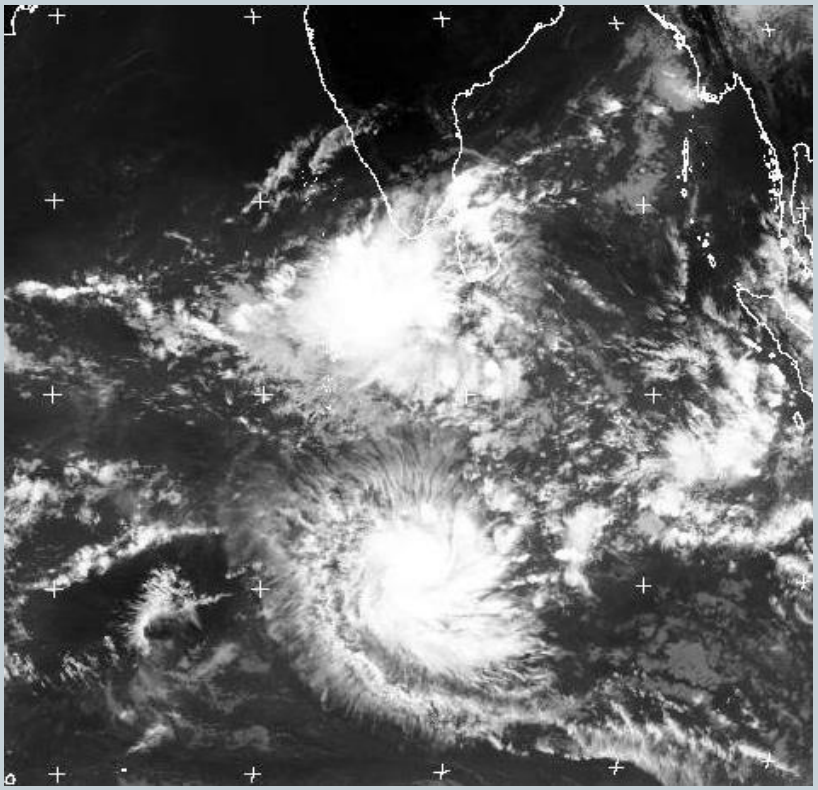
SWELL WAVES HIT MALDIVES ON 15 – 18TH MAY 2007. THE WAVE ORIGINATED FROM THE EXTRA-TROPICAL DEPRESSION IN THE SOUTHERN HEMISPHERE, APPROX. 5630KM SOUTHWEST OF ADDU. SWELL WAVES HIT AND FLOODED MORE THAN 60 ISLANDS INCLUDING ADDU , HUVADHU, THAA AND ARI ATOLL.

Tidal and Swell Waves

Large tidal waves hit Male' on 21 July 2012. Eastern part of Male' were affected. Some cafés in the area experienced power cuts and huge losses.

Tidal swells hit the eastern side of Malé at 11:30 pm on 12 August 2015. Flood water up to one and a half feet inundated cafés and restaurants.

Tropical Cyclones and their impacts



A depression formed about 350 miles SW of Gan on 29 May 1991

The lowest ever recorded atmospheric Pressure of 997.3 recorded on 29 May at 2100z

Strong winds of 92 – 104 mph lasts about 30 min. (w/s estimated)

Storm caused widespread damages to Addu city.

Regional Met Office also got hit by the storm.

Tropical Cyclones

Flash flooding in Huvadhu Atoll - 2002

- A low level circulation formed in the west of Huvadhoo Atoll – 05 July
- System moved over Huvadhoo Atoll on 09 July. Heavy downpours experienced in many islands in Huvadhoo Atoll.
- Highest rainfall record (then) 219.8 mm recorded in Kaadehdhoo Met Office – 09 July 2002

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MALDIVES METEOROLOGICAL SERVICE

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MMS Mandates:

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Vision

Provide accurate, timely and reliable meteorological information to minimize the impact on life and property while supporting sustainable socio-economic development of the Maldives.

Mission

- Timely dissemination of alerts and advisories on all natural disasters.
- Expansion and maintenance of weather observation net-work in accordance with international standards.
- Enable easy access of high quality historical meteorological data to the user community for Sustainable National Socio-Economic Development.
- Develop meteorological services and capacity building for the national requirement, and contribute to regional and international community.

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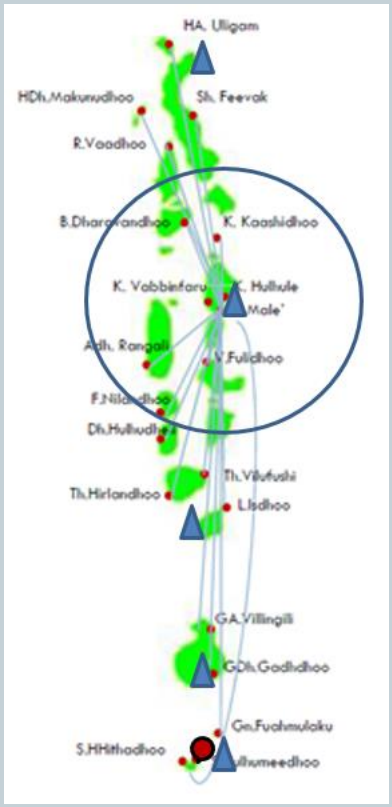
- Observation Network: 5 Manned, 20 AWS, 7 Rainfall sites
- Upper air (RS) station: 1 (South)
- Doppler Weather Radar : 1 (Central)
- Satellite Receiving System: 1
- Forecasters' Workstation (MESSIR COROBOR) : 1
- Global Tele-communication System: 1 GTS, 1 AFTN
- Numerical Weather Model
- Tide Gauges: 3 (North, Central, South)
- Ocean Buoy System: 1
- Broad-band Seismometers: 2



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- **OBSERVATION NETWORK**

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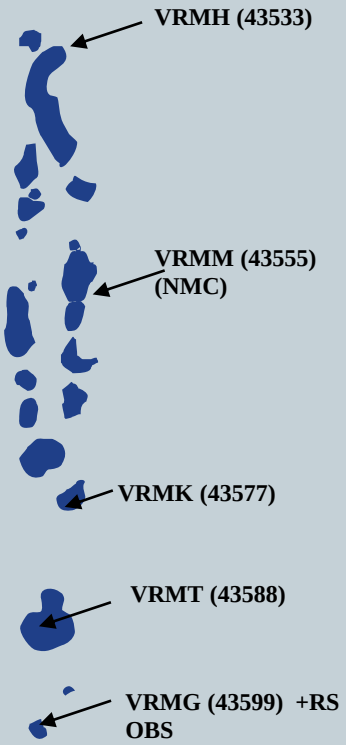

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- **RAINFALL OBSERVATION**

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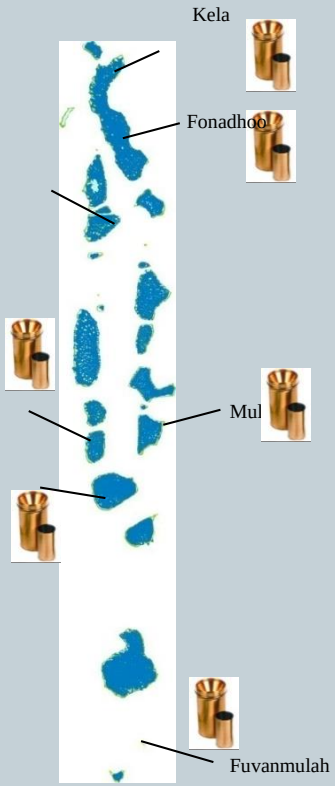

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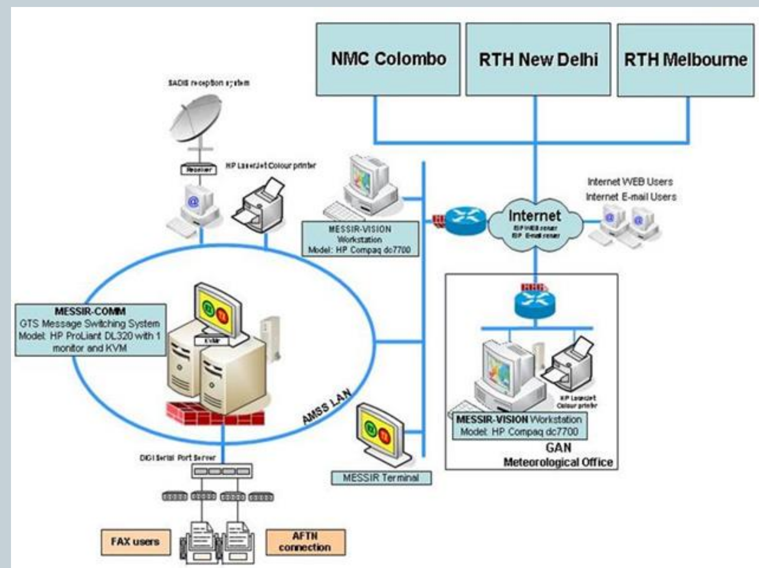
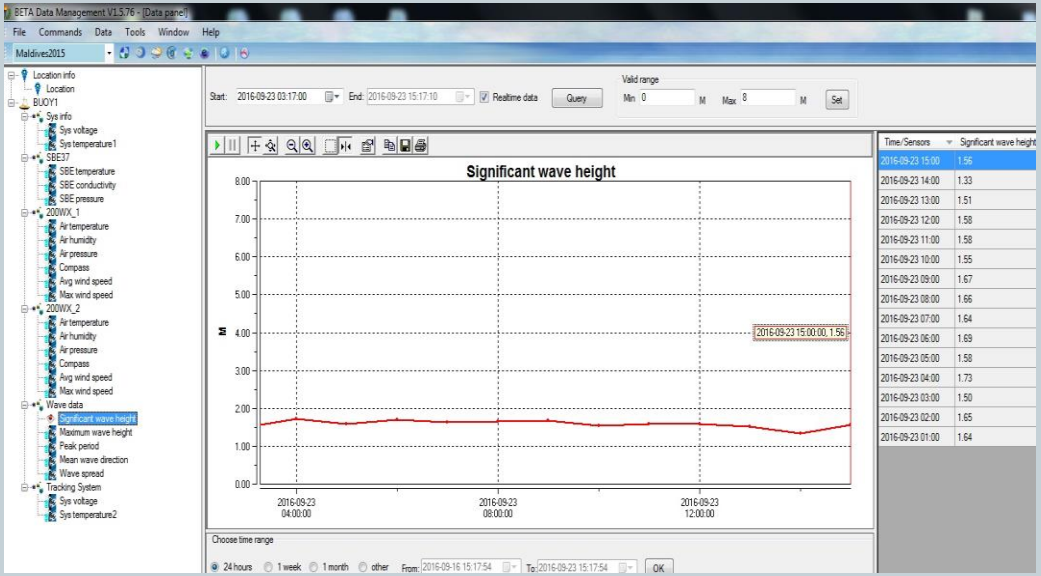

NMC Colombo
RTH New Delhi
RTH Melbourne
SADIS reception system
HP LaserJet Colour printer
MESSIR-VISION Workstation Model: HP Compaq dc7700
Internet
Internet WEB Users
Internet E-mail Users
MESSIR-COMM GTS Message Switching System Model: HP ProLiant DL320 with 1 monitor and KVM
AMSS LAN
MESSIR Terminal
MESSIR-VISION Workstation Model: HP Compaq dc7700
GAN Meteorological Office
DIGI Serial Port Server
FAX users
AFTN connection

Doppler Weather Radar

Ocean Observing System



One ocean buoy donated by FIO is installed 6nm south of Addu city. More of these systems are needed.

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Public Weather Service

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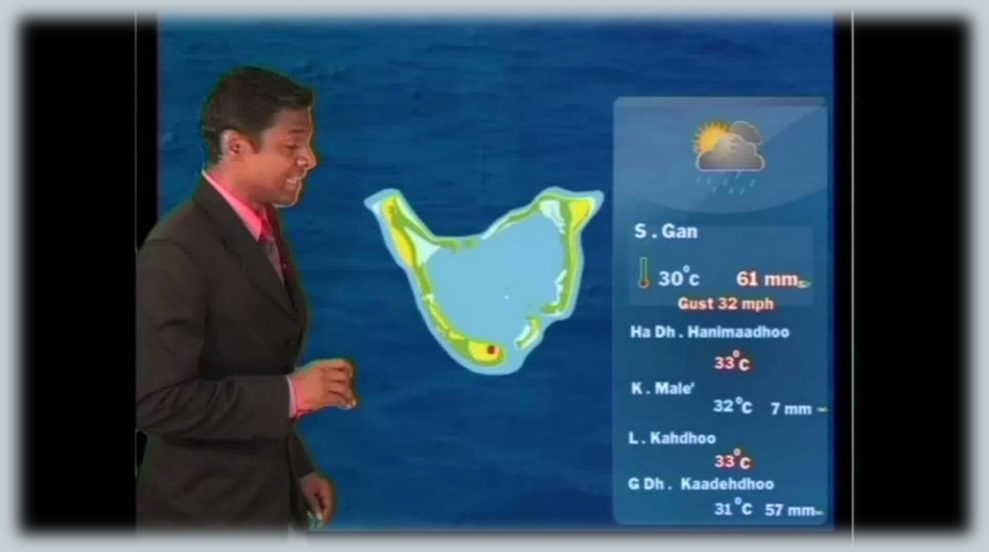
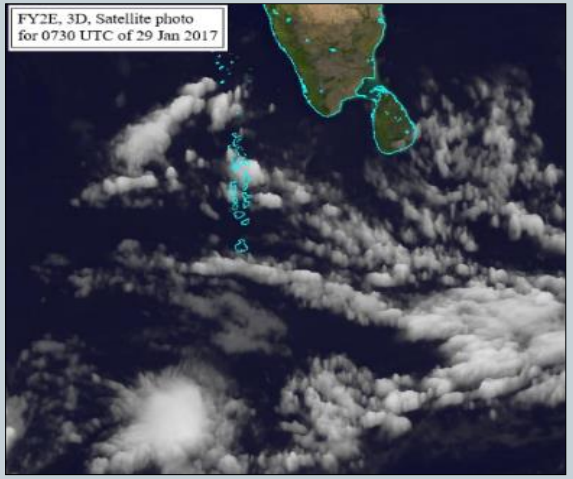
Public Weather Service

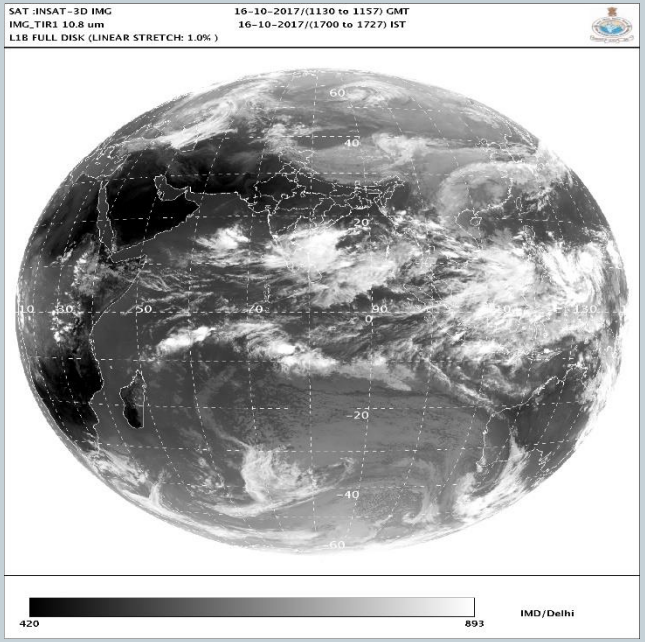
- TV weather presentations are prepared at the weather studio at MMS on a daily basis at 8 pm.
- Weather information to Radio channels on 6 hourly basis.



- The **CMACast** system donated by China Meteorological Administration in 2012 receives Satellite imageries from FY2E and FY2D series of Chinese geostationary satellites at an interval of 30 minutes.
- Surface synoptic data, Upper air sounding data, NWPs of ECMWF, T213: NWPs of CMA global model, NWP accumulation preci from Germany model and Japan model.
- Another component of this system is the application software MICAPS which enables to display satellite pictures, surface & upper air data, NWP products and overlay different products and analysis of various weather phenomena.



- The INSAT/ KALPANA satellite data are used by forecasters online.
- METEOSAT 8 imageries are viewed on the internet.
- Himawari and new generation other satellites do not cover Maldives area.



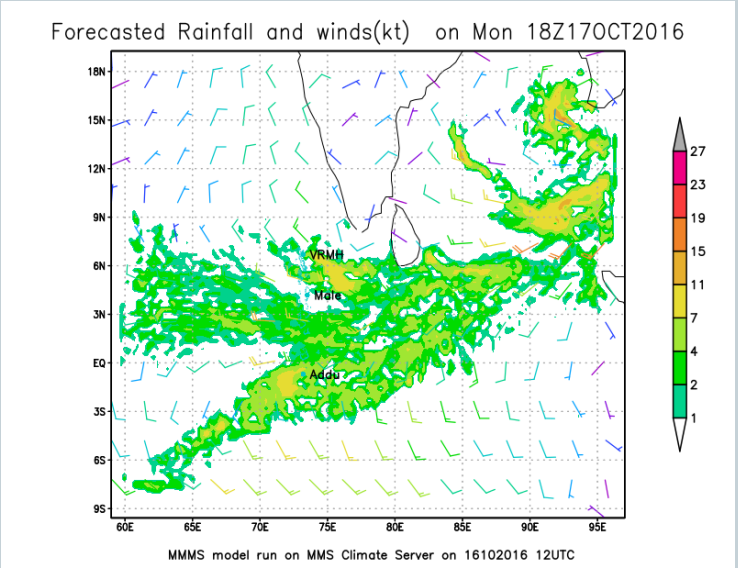
- MMS runs an NWP Model at 27 Km horizontal resolution on a daily basis.

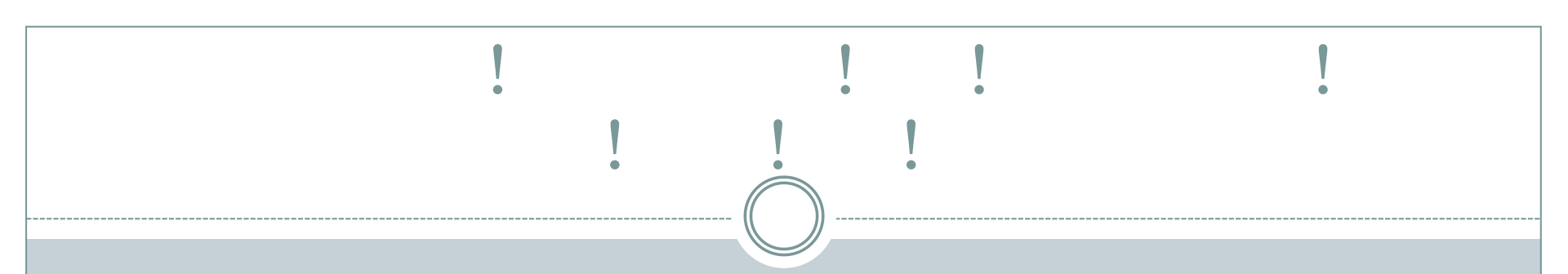
- WRF basic run made daily twice.
- If computing power elevated many improvements can be done.

- MMS needs training on data assimilation and other areas.

- MMS refers ECMWF products at online.

- RIMES and INCOIS provide some NWP products to MMS daily.





I. List of satellites/instruments currently used operationally for NWP, nowcasting and other applications
II. Current capabilities of collection, processing and archiving of satellite data and products
III. Current satellite data applications
    I. Key application areas
    II. Satellite-based products
IV. Satellite data and product needs and gaps

Gaps and Needs

- Lack of enough staff in weather forecasting and service delivery as well as for maintenance of equipment;
- Capacity building in Satellite and Radar Meteorology;
- Low computing power in Met Service;
- Limited observation network hence low data coverage; Gaps exist in information on currents and tidal/ swell waves propagating into the islands;
- Doppler Weather Radar coverage is NOT adequate.

What are expected from satellite imageries and integrated applications:

Estimated arrival time of :

- *Thunderstorms*
- *Heavy Rainfall*
- *Average Strong Wind, Gust winds*
- *Tidal and swell waves*

Data that shows:

- *Corel bleaching*
- *Ocean current and sea surface temperature*
- *Environmental Polution*

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We hope that by increase in the launching of new-generation geostationary satellites that cover Maldives' region would help overcome many shortcomings we currently face in providing forecasts, advisories and warnings.

Thank you